Experiences using situated and non-situated techniques for studying work in context

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ABSTRACT In this paper, we draw a distinction between situated techniques and non-situated techniques for studying work context. We define a situated technique as one in which the data collection takes place in the normal working environment of the person being studied. We describe our experience of a case study in which we applied a combination of situated and non-situated techniques to analyse work practice in context. To co-ordinate these different types of technique, and to provide adequate validation, we adopted an iterative model building approach.

Our case study demonstrates the feasibility and the value of combining these different techniques, and emphasises the value of model building and validation.

KEYWORDS Contextual inquiry, soft systems analysis, situated techniques, requirements gathering.

1. THE NEED FOR CONTEXTUAL TECHNIQUES IN HCI

There has been a growing awareness in the HCI and CSCW communities of the need to understand the contexts in which the technology we design is to be used. Holtzblatt and colleagues have developed a methodology, called contextual inquiry (Holtzblatt & Jones, 1993; Beyer & Holtzblatt, 1995; Holtzblatt & Beyer, 1996), which provides a number of techniques for studying work context. The need to study the context of work is also evident in the popularity of broadly ethnographic approaches to requirements gathering (Suchman 1995).

Outside of the HCI and CSCW community, the problem of understanding context has been recognised by some systems analysts. Soft Systems Analysis (Checkland, 1981; Checkland & Scholes, 1990; Patching, 1993) is a methodology for studying human activity systems with a view to specifying requirements for management intervention, often in the form of changes to information technology (IT) provision. This work has provided a number of interesting techniques

for studying context which have not yet penetrated the HCI community.

Soft Systems Analysis can be characterised in terms of a number of steps. Initially, analysis begins with an unstructured problem situation. By using interview techniques and a recording method known as rich pictures (see below) the analyst seeks to express the problem situation. An important goal at this stage of analysis is to understand the problem situation in its real world context. Following the expression of the problem situation, the next stages of analysis involve defining relevant systems and developing models of these systems. These 'ideal' models are then compared with the problem situation, and the comparison is used to identify desirable and feasible changes.

Comparing the soft systems approach with methods of studying context in HCI such as contextual inquiry and ethnography, reveals important differences. Firstly, in ethnography and contextual inquiry, data gathering takes place in the normal working environment of the subject. We may characterise these techniques as *situated* data collection techniques. In contrast, soft systems analysis typically collects data using interviews

in a *non-situated* manner. Secondly, soft-systems analysis places a strong emphasis on the use of models as tools to aid understanding of the work context.

In this paper, we report on a study which sought to combine situated and non-situated data gathering techniques in analysing the 'quality of fit' between the work done by a group of office workers and the IT provided to support that work.

2. THE STUDY

The organisation referred to in this study (which has to remain anonymous for confidentiality reasons) processes financial claims made by customers. Staff in the organisation receive claim forms from customers and have to assess whether the customer is eligible for payments, often over an extended period of time. Customers who are currently eligible may cease to be eligible and cases must therefore be updated and reviewed. Performance measures such as speed of claim processing and accuracy of payments calculation are also important aspects of the work of the assessors.

Our study had a very specific brief, to investigate and report on three related issues.

- 1) *To describe the work of the assessors.*
- 2) *To analyse the 'quality of fit' between the IT and the work of assessors.*
- 3) *To survey new technologies that might be of use to the organisation in the short, medium and long term.*

The study was subject to time constraints. The total workload was 22 person days, with 12 half days being allocated to on-site data gathering activities. This constraint was significant when compared to the time-scales that relate to the processing of a customer's claim. For example: the targets for processing of a claim are of the order of a few days; some of the assessor's work may involve issuing requests for information with a turnaround measured in weeks; and the total period of a customer's claim may be a number of months or years.

These time constraints had a significant effect on our selection of appropriate techniques. We decided that there was a *prima-facie* case for using some situated data gathering techniques (Beyer & Holtzblatt, 1993; Suchman, 1993). However, we were concerned that, using these techniques alone, we might not obtain a sufficiently broad sample of the work within the time available (Hughes et al., 1995). Consequently, we chose

to supplement these techniques with non-situated data collection techniques drawn from soft systems analysis. To co-ordinate the use of these two different data gathering methods, to support synthesis of the data, and to support validation, we introduced an iterative model building activity. In practice, we found that the model building activity delivered an additional benefit in highlighting issues that required further investigation.

3. THE TECHNIQUES SELECTED

In considering the techniques that we used, we group them under three headings: techniques to support situated data collection; non-situated techniques to investigate aspects of context outside of the immediately observable situation; and techniques to support validation.

3.1. Situated data gathering

Contextual interviews

Our primary situated data gathering technique was the use of contextual interviews, as described by Beyer & Holtzblatt (1995) and Holtzblatt & Jones (1993). In a contextual interview the investigator observes the interviewee carrying out his or her normal work. The investigator uses the interviewee's activities and artefacts in the work environment as cues for inquiry. For instance, if the interviewee is observed using some tool, the place of the tool in the work can be discussed, and the interviewee can be asked about other tools that are available in the environment. Similarly, when the interviewee is conducting some activity, the ordering and the structure of the activity can be discussed.

This technique seemed particularly appropriate for gathering information about how the IT was used within the work, and how well the structure of the software matched to the assessors' preferred structure for the work.

Train me and cramming

The work of assessors is highly technical and considerable subject matter expertise and domain-specific language pervades the work. This presents a problem for a contextual interview, since much valuable interview time could be lost negotiating terminology. To overcome this problem we invested a significant amount of our available time on a 'train me' session with one of the organisation's training staff using standard training materials; and on cramming, i.e.

studying documentation to learn the structure of the computer system. Whilst this work was not *situated* in terms of our definitions, we include it here because it we used it to support situated data collection.

Although we cannot claim this as a new 'technique' we believe that this activity should not be overlooked by any practitioner seeking to use situated data collection techniques to study human-computer interaction.

Action Recorder

One possible exercise within a contextual interview is to record a 'day in the life' of the worker being studied. We supplemented this high level, low granularity description of the assessors' work with a more fine grained analysis of activities over a shorter time window using 'Action Recorder' (Watts et al., 1996).

Action Recorder allows an observer to monitor the changing activities of a person and a set of tools by making a single key press whenever either the person's activity changes, or the state of a tool changes.

We used Action Recorder to produce logs of assessors' activities, and changes to the computer system state, over forty minute periods. Conventionally, this would be done by video recording the activity and then analysing the video back in the laboratory. In our study, time constraints did not allow for this, instead, we entered the data points in real time.

3.2. Going beyond the immediate situation

Some of the events that we needed to consider in analysing the context of work, were beyond the scope of the immediately observable situation. For instance, a customer's claim may run over many months, and the history of a claim may be relevant to our understanding of an assessor's work. Similarly, some of the work may involve outside bodies or agents that are not persistently represented in the situation of work. We used non-situated techniques to explore these issues.

Semi-structured interviews and rich pictures

Semi-structured interviews are a standard data gathering technique, and are used within the Soft Systems Analysis methodology (Patching 1993) to elicit information about the context of a 'problem situation'. We used such interviews to investigate: the contact that assessors had with external bodies and individuals; the assessors' attitudes to their work and the tools available;

the sources of information used in the work; particular problems that they had identified etc. The interviews were recorded on audio tape. Also, during the interview, we worked with the interviewees to produce 'rich pictures'.

Rich pictures are freehand sketches drawn during an interview session to represent aspects of the information being discussed. Elements of rich pictures may include: actors and artefacts in a situation; the roles of actors, relationships between actors, and between actors and artefacts; communications between actors; issues relating to those actors or artefacts. In fact, any information that the person drawing the picture thinks may help in understanding the situation. The rich picture should be regarded primarily as an *aide memoir* for the interviewer, rather than as a complete recording of a set of specific observations. Figure 1 shows an example of a rich picture representing the context of a public house, taken from Patching (1993).

Figure 1: An example of a rich picture of a pub (based on Patching 1993). Crosses indicate possible conflicts.

Scenario analysis

The organisation's concern for accuracy, led us to consider techniques for gathering data about the possible causes of errors in claims processing. Errors present a major challenge for situated observation techniques, since errors are unlikely to occur during observation sessions and, when errors do occur, they may not be recognised by the observer due to his or her limited domain knowledge.

In conjunction with quality controllers, we constructed a number of error scenarios, to find out more about the nature of errors in the assessors' work. We then used these error scenarios in a focus group

discussion with assessment team leaders, to identify possible problem areas in the work or in the IT support that might have been related to these particular errors.

3.3. Validating our understanding of the work

The process of producing a report that may lead to changes in a work-system, places an obligation on the writer to ensure that the information in the report is valid and respects the viewpoints of the people within the work-system. We used three techniques to support validation.

Model building

We used model building to co-ordinate our data gathering using these heterogeneous methods, and to support validation of our understanding of the data. The models were in the form of informal diagrams that expressed particular aspects of our understanding. An example of one of the models is shown in figure 2.

The process of model building forces the analyst to explicate his or her understanding of the situation. This helps to clarify that understanding, and to identify hidden assumptions, contradictions or gaps in the analysts' knowledge. Having an explicit representation of this understanding may generate new insights and provoke new questions.

Challenging assumptions

The second validation technique was the technique of 'challenging assumptions'.

Using our understanding of the work, and our models, we produced a series of statements that were either consequences of the models, or contradicted our models. Many of the statements were designed to be provocative or extreme, in order to involve assessors in debating points of contention, and to provide stronger tests of our hypotheses.

The statements were presented to two focus groups. The first focus group consisted of five assessors. The second group involved two assessment team leaders, a trainer and a quality controller.

Wish lists

The final validation technique was a wish list exercise. All of the off-line interviews had terminated with questions about the best and worst aspects of the work and the tools provided, and 'wishes' for possible changes. Because the assessors' knowledge of available technology was constrained by their experience, we

supplemented their wishes with additional possibilities based on our own knowledge. To avoid bias, we did not indicate to participants which wishes were generated by their peers and which by us.

Each of these wishes was written on a small (A6) piece of card. Within the focus groups, we asked the participants to write down new wishes on more cards. The final collection was then displayed, grouped and discussed.

4. EVALUATING THE TECHNIQUES

In this section, we report on the data that we found using each of the techniques, and consider what general lessons can be learned about the technique, from this case study.

4.1. Situated data gathering

Contextual Interviews

One of the most important things we discovered about the work during the study was that change and history are very significant when assessing a customer's claim and planning payments. The following observations (among many) from a contextual inquiry session made this apparent:

When customers made telephone enquiries, assessors were observed to visit one particular screen more often than others. The screen is a free text notes page. The notes page is 12 lines long and, when full, is dumped to a paper copy, before new information is inserted. It is standard practice, in one of the offices visited, to use two lines of the page to record the customer's previous address(es). Given the space available, this indicates the importance that the assessors (and their managers) attach to this historical information.

An assessor dealing with a complex claim left her desk and went into a separate office to use a stand-alone PC. On the PC she used a spreadsheet, then returned to her desk and used the output from the PC to update the customer's file on the main computer system. Further questioning revealed that the work on the PC was a comparison of the customer's entitlements and payments from the organisation over the last 18 months, to identify possible arrears or overpayments.

These kind of incidents are very easy to detect using a contextual interview. Both incidents were quite unexpected to us as observers, and consequently it is

unlikely that we would have been able to lead the assessor to talk about these in a more structured off-line interview. Meanwhile, the assessors might have seen use of the free text notes, for example, as so obvious that it was not worthy of mention in the interview, or at too low a level of detail for a rich picture.

A second important aspect of the work, that was easily identified using situated observation, was the frequency with which work was interrupted by telephone calls, or requests from other staff for information about a customer's claim. Such interruption occurred often and at times when the assessor was in the middle of a complex investigation. The interruptions were invariably concerned with matters unrelated to the assessor's current claim.

'Train me' and cramming

A major benefit of this exercise was the improvement to our ability to follow the work of the assessors without being overwhelmed by the complexity of their navigation around the computer system. Assessors typically visit between 5 and 10 out of more than 50 available different dialogue screens in the course of a 5 minute telephone call. By cramming, we learned the most important screen numbers, which were displayed in a common location across all the dialogue screens. This enabled us to observe the order in which the work was conducted, without interrupting after every navigation.

A secondary, more intangible benefit may have been in giving us as observers more credibility when working with the assessors.

Finally, having some understanding of the ideal view of the work embodied in procedural guides and in the design of the computer system, gave us a reference point to compare against the flow of work as it is actually practised.

Action Recorder

Although we were unable to collect sufficient data using action recorder to generate significant statistical results, analysis of the records provided us with useful supporting evidence about the distribution of assessors' activities.

In particular, we were able to demonstrate our contention that most of the work was concerned with investigating a few complex cases, rather than processing large number of simple cases. During one recording session (of 45 minutes), the assessor was primarily working on a single case, switching back after each of 4 telephone interruptions, and 2

interruptions by colleagues which took up over 35% of the recording session.

4.2. Going beyond the immediate situation

Semi-structured interviews and rich pictures

Some major issues were identified through the off-line interviews, that might have been difficult to uncover using contextual observations alone. Some typical examples are given below.

A number of assessors felt that the speed with which new products were introduced and old products revised, made it difficult for changes to 'bed down'. As with any organisation, new systems inevitably encounter 'teething troubles'. The assessors that we interviewed felt that dealing with such problems was a significant source of pressure for them.

In one interview the assessor compared the current situation with the previous paper-based arrangements. In the clerical system, where multiple customers claims were related in a particular way, their files were kept together as a single unit. In the computer system this link is recorded using the free text notes, and the assessor has to retrieve the other customers' details manually.

As the above examples illustrate, the kind of issues made apparent by the off-line techniques, were concerned with the organisational and historical context of the work, i.e. aspects of the work that were largely beyond the day-to-day work of claims processing. Such issues need to be considered in HCI design.

The importance of the telephone also arose in the off-line interviews. Whilst our situated observation had established the fact that telephone interruptions occurred frequently, it was the off-line interview that allowed us to explore the organisational context that explains why the work is the way it is.

During one interview an assessor described how the management were promoting a 'single point of contact' for customers. The single point of contact meant that a customer should be able to talk to one person who could explain precisely what point the customer's claim had reached. This philosophy led to the situation where a customer would be put through from the switchboard to the assessor who was dealing with their claim. This in turn led to the high level of telephone interruptions

that we had observed. Previously, the role of assessing claims was separated from the role of dealing with customer enquiries.

Taking the assessors out of the situation, and allowing them to step back and reflect on their work, allowed them to voice general concerns that they might normally ignore in their day-to-day work.

Scenario analysis

For all of our selected error scenarios, we found that the focus group participants quickly reached a consensus on those components of the work that were the most likely sources of the error. We asked the participants to map each scenario description to one of the components of our process model (figure 3). The results suggested that the information gathering part of the process, which was not well supported by the IT, was a very common source of error.

The exercise had the additional benefit of providing some validation of our process model.

4.3. Validating our understanding

Model building

We constructed two major models.

The first model, figure 2, illustrates the context in which the assessors work. In the model, three separate environments are identified: the assessors office environment, the external environment and the systems environment. The systems environment contains representations (denoted by *) of aspects of the other two environments. For example, the fact that knowledge about the administrative world is encapsulated in the computer system's behaviour is represented by 'administrative world*' in the systems environment. Similarly, the system's knowledge about the customer is denoted as 'customer's world*'. The model also highlights the fact that the assessor has only a limited 'window' on the external and systems environments. Information flows between the three environments.

Figure 2: A model of the assessor's work context.

The model building activity helped us to articulate a number of key aspects of the work context. In particular: that all the worlds are subject to change at different rates; that time lags between changes in the customer's, administrative and legal worlds and the corresponding worlds in the systems environment are unavoidable; and the dynamic nature of the assessors work in controlling the system to maintain a balance between the payments made by the system, and the customer's entitlements.

The second model was more closely related to classical human information processing models. Figure 3 shows the processing of an individual claim as a network of actions and decisions. The model divides the work of processing a single claim into a number of phases. Following some alerting signal, such as a letter, phone call, or a printed message from the computer system the first major phase is an information gathering and recording phase. This is followed by a decision whether to proceed with changes to the customer's file (shown as the box 'Ready?'). The next phase is a process of updating the customer's file, reviewing the changes, adjudicating (accepting the changes), planning payments and then setting case controls to alert the assessor when a need for further action may be expected.

The model building took place in between two phases of data collection, the latter being shaped markedly by the model building activity. The activity of the observer reporting back to a colleague who had not done any observation at this stage, proved to be extremely valuable. It offered a chance to reflect on the data collected, explicate assumptions that the observer had made, and highlight possible areas of uncertainty where further data collection was required.

Figure 3: The processing of a single customer's change of circumstance.

For example, in developing the process model shown in figure 3, we were suspicious of the strict sequential division between the 'information gathering' and 'updating file' activities. On purely intuitive grounds we would have expected these to be concurrent and iterative. By further investigation, we were able to confirm that there was a hard divide between information gathering and file updates, this being a consequence of the need to maintain strict consistency between the customers recorded circumstances and the current value of payments. During the information gathering activity, partial information is recorded using the notes page, and only when a full set of changes and evidence had been collected, is the main body of the customer's file updated. This point served to clarify the role of the notes page as a tool in managing the investigation of the customer's claim.

Examples of issues arising during the construction of the context model were: the relationship between the various computer systems that held information about

the customer; and how much of the communication between the computer system and the customer could be observed by the assessor. In fact, the computer system automatically generates letters composed of multiple standard paragraphs then sends them to the customer, without the assessor being able to inspect the content of the letter either before or after they are sent. This occasionally leads to the customer telephoning to ask for an explanation about a letter, the content of which is unknown to the assessor.

Challenging Assumptions

In the challenging assumptions exercise we presented the focus groups with provocative statements derived from, or contradicting the models, and designed to promote discussion. This exercise allowed us to engage the assessors in debating detailed points of our model and our understanding, where merely presenting the model might have provided us with less useful feedback.

Examples of statements that we used to promote discussion were: (1) the free text notes page is the most important screen; (2) automated interfaces to other computer systems are more trouble than they are worth; (3) Making the system more intelligent (e.g. reducing the number of clerical components) would not save me much time in a typical day; (4) 10% of the customers take up 90% of my time.

The participants greeted a number of our assumptions with scepticism and we were able to use this to encourage them to elaborate on the topics referred to by the assumptions. In some cases, this led us to new information about exceptions to our generalisations; in others it led us to temper the strength of our conclusions; in still others it led us to qualify our assertions. For example, in response to assumption (2), participants said that in fact, interfaces to other systems are invaluable in their day-to-day work, and were ultimately worth the extra effort that was required from them during their introduction. Their main concerns about the introduction of new software were that the software should be robust and that they should receive adequate training.

Wish Lists

The wish list exercise was our final validation technique. The discussion based around the wish lists were extremely fruitful in allowing us to gauge people's opinions about the possible software changes. Among the possibilities discussed were: improvements to the facilities for recording free text notes, electronic cut and

paste, electronic mail and on-line decision support systems. Improvements to the free text facilities were solutions based on existing technologies suggested by the participants themselves. Discussion here helped us to validate our belief in the importance of this resource. Issues such as electronic cut and paste took some participants beyond their current experience, but were recognised as possibly useful tools. Decision support systems were greeted with scepticism.

The discussion and emerging consensus allowed us to validate which requests were of genuine benefit to a large number of the assessors, and which were specific to one particular part of the work, or even peculiar to an individual.

5. DISCUSSION & CONCLUSIONS

The constraints on our study led us to combine situated and non-situated techniques for studying the context of work, co-ordinating these different approaches through iterative model building and validation. As we expected, the different data collection techniques proved effective for studying different aspects of the work context.

The situated techniques of contextual interviews supported by cramming, and use of Action Recorder provided important information about the work as practised and the day-to-day interaction with the computer system.

The non-situated techniques helped us to open out the organisational context and study issues that were physically or temporally located beyond the range of the immediately observable situation. The issues covered by these techniques included accuracy and errors, the history of work practices and artefacts, and significant events or processes that occur outside the assessors workplace.

Conceptual model building not only supported synthesis of these different data sources, suggested new insights and new questions to investigate during data collection, but also allowed us to engage assessors in the validation of our understanding before that understanding was embedded in the final report. Without such articulation and validation we do not feel we could have given sufficient voice to our participants.

From our experiences, we conclude that these elements: situated study, non-situated study, model

building and validation can be successfully combined to produce an integrated approach to the study of work context, and that some of the techniques developed within soft systems analysis deserve the attention of HCI practitioners.

One question that remains is what types of conceptual models are most effective for studies of work context? The style of our conceptual models, and our method of using them, differs substantially from the style and methods used in soft system analysis (Checkland, 1981), or in Contextual Design (Holtzblatt & Beyer, 1996). We cannot say whether or not these alternative modelling approaches could offer similar benefits.

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